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# 371 Application As-Filed

Level - 1  
Version 1.1  
Updated - 8/01/01  
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FORM PTO-1390 (REV. 5-93)	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	06 DE 020001 ATTORNEY'S DOCKET NUMBER 10191/2141
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		
INTERNATIONAL APPLICATION NO. PCT/DE01/01147	INTERNATIONAL FILING DATE 24th March 2001 (24.03.01)	U.S. APPLICATION NO. (if known, see 37 CFR 1.5) 10/009243 PRIORITY DATE CLAIMED: 08 April 2000 (08.04.00)
TITLE OF INVENTION ELECTRICAL PLUG CONNECTION		
APPLICANT(S) FOR DO/EO/US MAUE, Hans-Heinrich; HOFMEISTER, Werner; SHOENFELD, Michael; SIMMEL, Andreas		
Applicant(s) herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information		
1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.		
2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.		
3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)) immediately rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1)		
4. <input type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.		
5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))		
a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau).		
b. <input checked="" type="checkbox"/> has been transmitted by the International Bureau.		
c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US)		
6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)).		
7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))		
a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau)		
b. <input type="checkbox"/> have been transmitted by the International Bureau.		
c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired		
d. <input checked="" type="checkbox"/> have not been made and will not be made		
8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).		
9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)) UNSIGNED.		
10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).		
Items 11. to 16. below concern other document(s) or information included:		
11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.		
12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.		
13. <input checked="" type="checkbox"/> A <b>FIRST</b> preliminary amendment.		
<input type="checkbox"/> A <b>SECOND</b> or <b>SUBSEQUENT</b> preliminary amendment.		
14. <input checked="" type="checkbox"/> A substitute specification and marked-up version of substitute specification.		
15. <input type="checkbox"/> A change of power of attorney and/or address letter.		
16. <input checked="" type="checkbox"/> Other items or information: International Search Report, and PCT/RO/101.		



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Level - 2  
Version 1.1  
Updated - 8/01/01



[10191/2141]

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant(s) : Hans-Heinrich MAUE et al.  
Serial No. : To Be Assigned  
Filed : Herewith  
For : ELECTRICAL PLUG CONNECTION  
Art Unit : To Be Assigned  
Examiner : To Be Assigned  
Assistant Commissioner for Patents  
Washington, D.C. 20231

**PRELIMINARY AMENDMENT AND**  
**37 C.F.R. § 1.125 SUBSTITUTE SPECIFICATION STATEMENT**

SIR:

Please amend the above-identified application before examination, as set forth below.

**IN THE SPECIFICATION AND ABSTRACT:**

In accordance with 37 C.F.R. § 1.121(b)(3), a Substitute Specification (including the Abstract, but without claims) accompanies this response. It is respectfully requested that the Substitute Specification (including Abstract) be entered to replace the Specification of record.

**IN THE CLAIMS:**

Please cancel claims 1-6, without prejudice.

Please add the following new claims:

7. (New) An electrical plug connection comprising:  
first and second connectors adapted to be detachably coupled to one another  
in an axially running plug direction, the first connector including a housing;  
a receiving slot formed in the housing of the first connector;  
a flange protruding at the second connector, the flange at least regionally  
engaging with the receiving slot when the first and second connectors are coupled, the  
flange having an end face and having a side surface;

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a seal attached to the first connector, the seal being elastically deformed by the flange when the first and second connectors are coupled;

at least one first pressing element radially pressed against the side surface of the flange when the first and second connectors are coupled, the first pressing element projecting radially, transversely to the plug direction, into the receiving slot; and

at least one second pressing element receiving the end face of the flange under axially directed pressing tension at an end of a coupling operation of the first and second connectors, the second pressing element being situated in the receiving slot.

8. (New) The plug connection according to claim 7, further comprising a contact carrier, and wherein the first pressing element forms one piece with the contact carrier as part of the housing of the first connector and is composed of an inherently stable plastic.

9. (New) The plug connection according to claim 8, wherein the first pressing element extends around the contact carrier.

10. (New) The plug connection according to claim 8, wherein a circumferential extent of the first pressing element at the contact carrier is partially interrupted and forms individual pressing regions that can alternatively be re-formed into individual pressing points.

11. (New) The plug connection according to claim 8, wherein the second pressing element is situated at a closed end of the receiving slot and is formed in the contact carrier as a circumferential ring composed of an elastic material having a Shore hardness of at least 60.

12. (New) The plug connection according to claim 11, wherein the second pressing element is formed from hard rubber.

#### **Remarks**

This Preliminary Amendment cancels without prejudice claims 1-6 in the underlying PCT Application No. PCT/DE01/01147, and adds without prejudice new claims 7-12. The new claims conform the claims to U.S. Patent and Trademark Office rules and do not add new matter to the application.

In accordance with 37 C.F.R. § 1.121(b)(3), the Substitute Specification (including the Abstract, but without the claims) contains no new matter. The amendments reflected in the Substitute Specification (including Abstract) are to conform the Specification and Abstract to U.S. Patent and Trademark Office rules or to correct informalities. As required by 37 C.F.R. § 1.121(b)(3)(iii) and § 1.125(b)(2), a Marked Up Version Of The Substitute Specification comparing the Specification of record and the Substitute Specification also accompanies this Preliminary Amendment. Approval and entry of the Substitute Specification (including Abstract) is respectfully requested.

The underlying PCT Application No. PCT/DE01/01147 includes an International Search Report, dated August 21, 2001. The Search Report includes a list of documents that were uncovered in the underlying PCT Application. A copy of the Search Report accompanies this Preliminary Amendment.

Applicants assert that the subject matter of the present application is new, non-obvious, and useful. Prompt consideration and allowance of the application are respectfully requested.

Respectfully Submitted,

KENYON & KENYON

Dated: 12/6/01

By: [Signature]

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428891



[10191/2141]

## ELECTRICAL PLUG CONNECTION

### Background Information

[The present invention is based on an electrical plug connection according to the species defined in Claim 1.] An electrical plug connection having two connectors that can be detachably coupled to one another is known from German Patent No. DE 41 15 119 [C2].

The first connector has a contact carrier. Formed in the contact carrier are receiving chambers in which in each case one contact element is located. The contact elements are each connected via a connection segment to a cable. Clustered as a cable harness, the cables are brought out of the first connector on the reverse side. In a closed plug connection, the contact elements are electroconductively connected via contact segments to the appropriate contact parts of the second connector.

To seal the plug connection between the connectors, a sealing ring of an elastic material runs around the outside of the contact carrier of the first connector, the sealing ring engaging with a side surface of a sleeve-shaped flange of the second connector and deforming in a resilient manner when the two connectors are joined.

If such a plug connection is used in a motor vehicle, the connection is stressed during the operation of the motor vehicle by vibrational stresses, and relative movements occur between the two connectors since they are elastically coupled via the seal. These relative movements also occur between the contact elements of the first connector and the contact parts of the second connector, and they can result in the touching contact surfaces of the contact elements and the contact parts wearing through. The contacting is then carried out via the less effective contacting carrier material of these elements, thereby no longer ensuring the contact reliability of the plug connection. As a result, the performance reliability of the plug connection is undesirably affected.

MARKED-UP VERSION OF SUBSTITUTE SPECIFICATION

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### Summary [of the] Of The Invention

[In comparison with the related art, the] The plug connection according to the present invention [and having the characterizing features of Claim 1] has the advantage that the previously mentioned shortcomings are avoided.

For this purpose, a first pressing element, which is radially pressed against the flange of the mating connector, as well as a second pressing element, which receives an end face of the flange under an axially directed pressing tension at the end of the coupling process of the two connectors, are attached to the first connector in addition to the sealing element. The clearance of motion that was unavoidable in the case of the related art due to the deformability of the sealing element needed for functionality is eliminated by the pressing elements. As a result, the two connectors behave in a coupled state as if they were one piece. This transfers to the contact elements and contact parts situated in the fixed connectors, thereby producing a stable connection.

Due to this formation of the connectors, the vibrational stresses introduced to the contact elements and contact parts are advantageously reduced to the extent that they no longer jeopardize the functionality of the plug connection.

[Advantageous measures for implementing the present invention are specified in the dependent claims.]

### Brief Description of the Drawing

An exemplary embodiment of the present invention is represented in the drawing and explained in detail in the following description.] Brief Description Of The Drawings

Figure 1 shows a sectional view of a first connector coupled with a second

**MARKED-UP VERSION OF SUBSTITUTE SPECIFICATION**



contact carrier 15.

To form a radial seal, seal 27 has a plurality of circumferential, radially directed sealing lips 28, which are axially offset from one another.

5

When joining both connectors 12, 13, sealing lips 28 are gripped by sleeve-shaped flange 26 of second connector 13 and are partially resiliently deflected at a side surface 29 of flange 26 in the axial direction, in the opposite direction of arrow 17. Thus, both connectors 12, 13 are sealed relative to each other by seal 27.

10

In accordance with the deformability necessary for functionality, seal 27 is made of a soft, elastic material, so that given vibrational stresses of plug connection 11, the seal is not able to prevent undesired relative movements between coupled connectors 12, 13 due to vibrational stresses and due to the different masses of both connectors 12, 13.

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To rigidly couple connectors 12, 13 also under vibrational stresses, a first pressing element 31 and a second pressing element 32 are provided. First pressing element 31, which is represented in the figures in a super-elevated manner, is formed as a circumferential protuberance of contact carrier 15, which is made of an inherently stable plastic, and forms one piece with the contact carrier. In this context, the pressing element protrudes from a sidewall 33 of contact carrier 15 in a radial direction and partially projects into receiving slot 24 such that when inserting flange 26 into receiving slot 24, the pressing element is radially pressed against side surface 29 in the end segment of flange 26.

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Alternatively, the circumferential extent of first pressing element 31 can be partially interrupted and can form single pressing regions, the pressing regions also being able to be re-formed into individual pressing points, so-called pressing warts.

30

Second pressing element 32 is situated at the closed end of receiving slot 24 and is formed as a circumferential ring having rectangular cross-sectional areas. Second pressing element 32 is made of a hard rubber and has a Shore hardness of at least 60. At the end of the coupling operation of both connectors 12, 13, second pressing element 32 receives an end face 34 at the free end of flange 26 under axially directed pressing tension.

As a result of pressing elements 31, 32, both connectors 12, 13 are radially as well as axially biased relatively to each other after the completed coupling process. In this manner, both connectors 12, 13 form a one-piece unit, which can, however, be detached as needed. This one-piece design (integral formation) transfers to contact elements 18 and contact parts 21, which are situated in connectors 12, 13, and whose connection is fixed in the same manner.

As a result of contact elements 18 being connected in a stable manner to contact parts 21, functionality-threatening relative movements between contact elements 18 and contact parts 21 in response to vibrational stresses acting on plug connection 11 are reduced to being uncritical, so that plug connection 11 remains functionally stable even under these unfavorable operating conditions. As a result, it is possible to attach plug connection 11 directly to an aggregate of an internal combustion engine.

Abstract Of The Disclosure

A multipole electrical plug connection [is to be designed in such a manner that it] remains functionally stable even under vibrational stresses, in particular during the operation of an internal combustion engine. [

]The plug connection [(11)] is formed by coupling a first connector [(12)] to a second connector[(13)]. Attached to a contact carrier [(15)] as part of a housing [(14)] of the first connector [(12)] are a first pressing element [(31)] and a second pressing element[(32)], via which the two connectors [(12, 13)] are radially and axially biased when both connectors [(12, 13)] are joined. As a result, relative movements between the contacted contact elements [(18)] and contact parts [(21)] situated in the fixed connectors [(12, 13)] are prevented. [

]The plug connection [(11)] is preferably intended for use in automobile manufacturing.

[(Figure 2)]

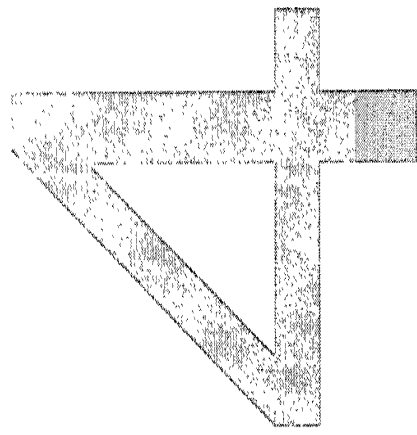
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11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

UNITED STATES PATENT AND TRADEMARK OFFICE  
DOCUMENT CLASSIFICATION BARCODE SHEET



# Specification



Level - 2  
Version 1.1  
Updated - 8/01/01



[10191/2141]

## ELECTRICAL PLUG CONNECTION

### Background Information

An electrical plug connection having two connectors that can be detachably coupled to one another is known from German Patent No. DE 41 15 119.

5 The first connector has a contact carrier. Formed in the contact carrier are receiving chambers in which in each case one contact element is located. The contact elements are each connected via a connection segment to a cable. Clustered as a cable harness, the cables are brought out of the first connector on the reverse side. In a closed plug connection, the contact elements are electroconductively connected via contact segments to the appropriate contact parts of the second connector.

10

To seal the plug connection between the connectors, a sealing ring of an elastic material runs around the outside of the contact carrier of the first connector, the sealing ring engaging with a side surface of a sleeve-shaped flange of the second connector and deforming in a resilient manner when the two connectors are joined.

15

If such a plug connection is used in a motor vehicle, the connection is stressed during the operation of the motor vehicle by vibrational stresses, and relative movements occur between the two connectors since they are elastically coupled via the seal. These relative movements also occur between the contact elements of the first connector and the contact parts of the second connector, and they can result in the touching contact surfaces of the contact elements and the contact parts wearing through. The contacting is then carried out via the less effective contacting carrier material of these elements, thereby no longer ensuring the contact reliability of the plug connection. As a result, the performance reliability of the plug connection is undesirably affected.

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SUBSTITUTE SPECIFICATION



### Summary Of The Invention

The plug connection according to the present invention has the advantage that the previously mentioned shortcomings are avoided.

5 For this purpose, a first pressing element, which is radially pressed against the flange of the mating connector, as well as a second pressing element, which receives an end face of the flange under an axially directed pressing tension at the end of the coupling process of the two connectors, are attached to the first connector in addition to the sealing element. The clearance of motion that was unavoidable in the case of the related art due to the deformability of the sealing element needed for functionality is eliminated by the pressing elements. As a result, the two connectors behave in a coupled state as if they were one piece. This transfers to the contact elements and contact parts situated in the fixed connectors, thereby producing a stable connection.

15

Due to this formation of the connectors, the vibrational stresses introduced to the contact elements and contact parts are advantageously reduced to the extent that they no longer jeopardize the functionality of the plug connection.

### Brief Description Of The Drawings

Figure 1 shows a sectional view of a first connector coupled with a second connector to form an electrical plug connection.

Figure 2 shows an enlarged section of Figure 1.

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### Detailed Description

An electrical plug connection 11 shown in Figures 1 and 2 has a first connector 12 and a second connector 13. First connector 12 is configured as a movable cable-harness plug, while second connector 13 is attached in a stationary manner as a attachment plug to an electrical aggregate, in particular to a diesel injection

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## **SUBSTITUTE SPECIFICATION**

pump. Connectors 12, 13 are detachably coupled to one another.

First connector 12 has a housing 14 formed as a grip-type shell, which is formed as a contact carrier 15 on the inside. As the rest of housing 14, contact carrier 15 is made of an electrically insulating plastic and includes a number of receiving chambers 16 corresponding to the pole number of first connector 12, the receiving chambers penetrating contact carrier 15 in the axial direction, along an arrow 17. Inserted in the direction of arrow 17 in every receiving chamber 16 is a contact element 18, which is only schematically represented.

At one end, contact element 18 has a contact segment 19, via which contact element 18 contacts an associated contact part 21 of second connector 13. Formed at the other end of contact element 18 is a fastening segment 22, to which an electric cable 23 is attached in an electrically contacting manner, the cable, upon emerging from contact carrier 14, being combined in a manner not shown with the other cables of the other contact elements 18 to form a cable harness.

Formed in contact carrier 15 as part of housing 14 is an axially directed, circumferential receiving slot 24 for accommodating an end segment of a corresponding flange 26 of second connector 13 when joining both connectors 12, 13. To seal plug connection 11 between connectors 12, 13, a seal 27 is attached to contact carrier 15.

To form a radial seal, seal 27 has a plurality of circumferential, radially directed sealing lips 28, which are axially offset from one another.

When joining both connectors 12, 13, sealing lips 28 are gripped by sleeve-shaped flange 26 of second connector 13 and are partially resiliently deflected at a side surface 29 of flange 26 in the axial direction, in the opposite direction of arrow 17. Thus, both connectors 12, 13 are sealed relative to each other by seal 27.

## SUBSTITUTE SPECIFICATION

In accordance with the deformability necessary for functionality, seal 27 is made of a soft, elastic material, so that given vibrational stresses of plug connection 11, the seal is not able to prevent undesired relative movements between coupled connectors 12, 13 due to vibrational stresses and due to the different masses of both connectors 12, 13.

To rigidly couple connectors 12, 13 also under vibrational stresses, a first pressing element 31 and a second pressing element 32 are provided. First pressing element 31, which is represented in the figures in a superelevated manner, is formed as a circumferential protuberance of contact carrier 15, which is made of an inherently stable plastic, and forms one piece with the contact carrier. In this context, the pressing element protrudes from a sidewall 33 of contact carrier 15 in a radial direction and partially projects into receiving slot 24 such that when inserting flange 26 into receiving slot 24, the pressing element is radially pressed against side surface 29 in the end segment of flange 26.

Alternatively, the circumferential extent of first pressing element 31 can be partially interrupted and can form single pressing regions, the pressing regions also being able to be re-formed into individual pressing points, so-called pressing warts.

Second pressing element 32 is situated at the closed end of receiving slot 24 and is formed as a circumferential ring having rectangular cross-sectional areas. Second pressing element 32 is made of a hard rubber and has a Shore hardness of at least 60. At the end of the coupling operation of both connectors 12, 13, second pressing element 32 receives an end face 34 at the free end of flange 26 under axially directed pressing tension.

As a result of pressing elements 31, 32, both connectors 12, 13 are radially as well as axially biased relatively to each other after the completed coupling process. In this manner, both connectors 12, 13 form a one-piece unit, which can, however, be

#### **SUBSTITUTE SPECIFICATION**

detached as needed. This one-piece design (integral formation) transfers to contact elements 18 and contact parts 21, which are situated in connectors 12, 13, and whose connection is fixed in the same manner.

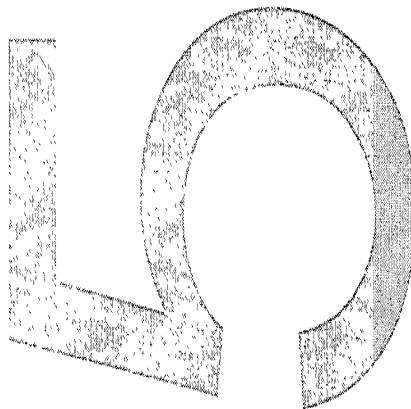
5 As a result of contact elements 18 being connected in a stable manner to contact parts 21, functionality-threatening relative movements between contact elements 18 and contact parts 21 in response to vibrational stresses acting on plug connection 11 are reduced to being uncritical, so that plug connection 11 remains functionally stable even under these unfavorable operating conditions. As a result, it is possible  
10 to attach plug connection 11 directly to an aggregate of an internal combustion engine.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62

UNITED STATES PATENT AND TRADEMARK OFFICE  
DOCUMENT CLASSIFICATION BARCODE SHEET



# Claims



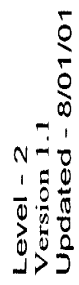
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What is claimed is:

1. An electrical plug connection having a first connector (12) and a second connector (13), which can be detachably coupled to one another in an axially running plug direction, a receiving slot (24) formed in a housing (14) of the first connector part (12), a flange (26), which protrudes at the second connector (13), at least regionally engaging with the receiving slot (24) when the two connector parts (12, 13) are coupled, and having a seal (27), which is attached to the first connector (12) and is elastically deformed by the flange (26) when the two connectors (12, 13) are coupled, wherein at least a first pressing element (31), which is radially pressed against a side surface (29) of the flange (26) when the two connectors (12, 13) are coupled, projects radially, transversely to the plug direction, into the receiving slot (24); and at least a second pressing element (32), which receives an end face (34) of the flange (26) under axially directed pressing tension at the end of the coupling operation of the two connectors (12, 13), is situated in the receiving slot (24).
2. The plug connection as recited in Claim 1, wherein the first pressing element (31) forms one piece with a contact carrier (15) as part of the housing (14) of the first connector (12) and is made of an inherently stable plastic.
3. The plug connection as recited in Claim 2, wherein the first pressing element (31) runs around the contact carrier (15).
4. The plug connection as recited in Claim 2, wherein the circumferential extent of first pressing element (31) at the contact carrier (15) is partially interrupted and forms individual pressing regions that can alternatively be re-formed into individual pressing points.

5. The plug connection as recited in one of the preceding claims, wherein the second pressing element (32) is situated at the closed end of the receiving slot (24) and is formed in the contact carrier (15) as a circumferential ring made of a hard elastic material having a Shore hardness of at least 60.
6. The plug connection as recited in Claim 5, wherein the second pressing element (32) is formed from hard rubber.

1. The first step in the process of creating a new product is to identify a market need. This involves conducting market research to understand what consumers want and what problems they are facing. Once a need is identified, the next step is to develop a concept that addresses this need. This is often done through brainstorming sessions with a team of designers and engineers. The concept is then refined through prototyping and testing, ensuring that it meets the requirements of the market. Finally, the product is launched into the market, and its performance is monitored to ensure it continues to meet the needs of consumers.





Abstract Of The Disclosure

A multipole electrical plug connection remains functionally stable even under vibrational stresses, in particular during the operation of an internal combustion engine. The plug connection is formed by coupling a first connector to a second connector. Attached to a contact carrier as part of a housing of the first connector are a first pressing element and a second pressing element, via which the two connectors are radially and axially biased when both connectors are joined. As a result, relative movements between the contacted contact elements and contact parts situated in the fixed connectors are prevented. The plug connection is preferably intended for use in automobile manufacturing.



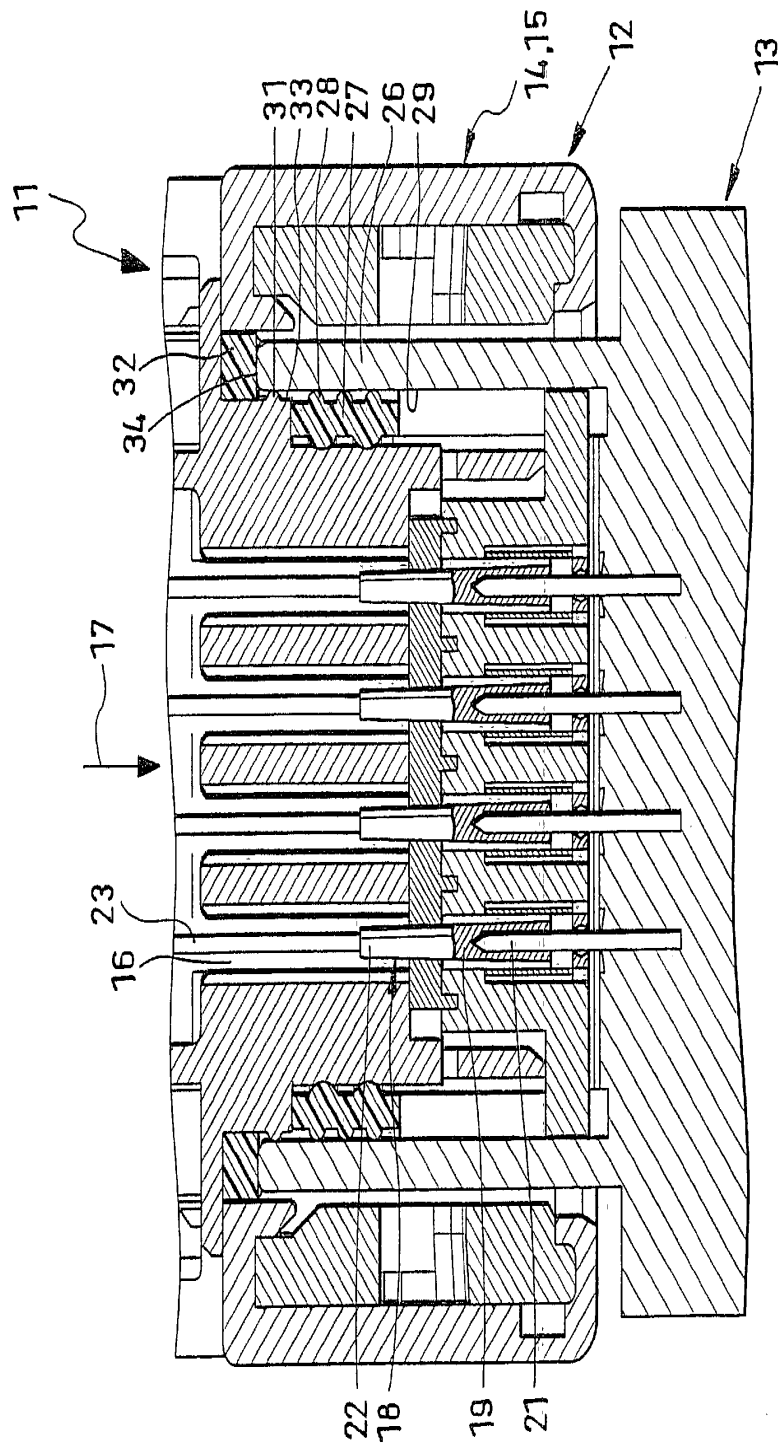


Fig. 1

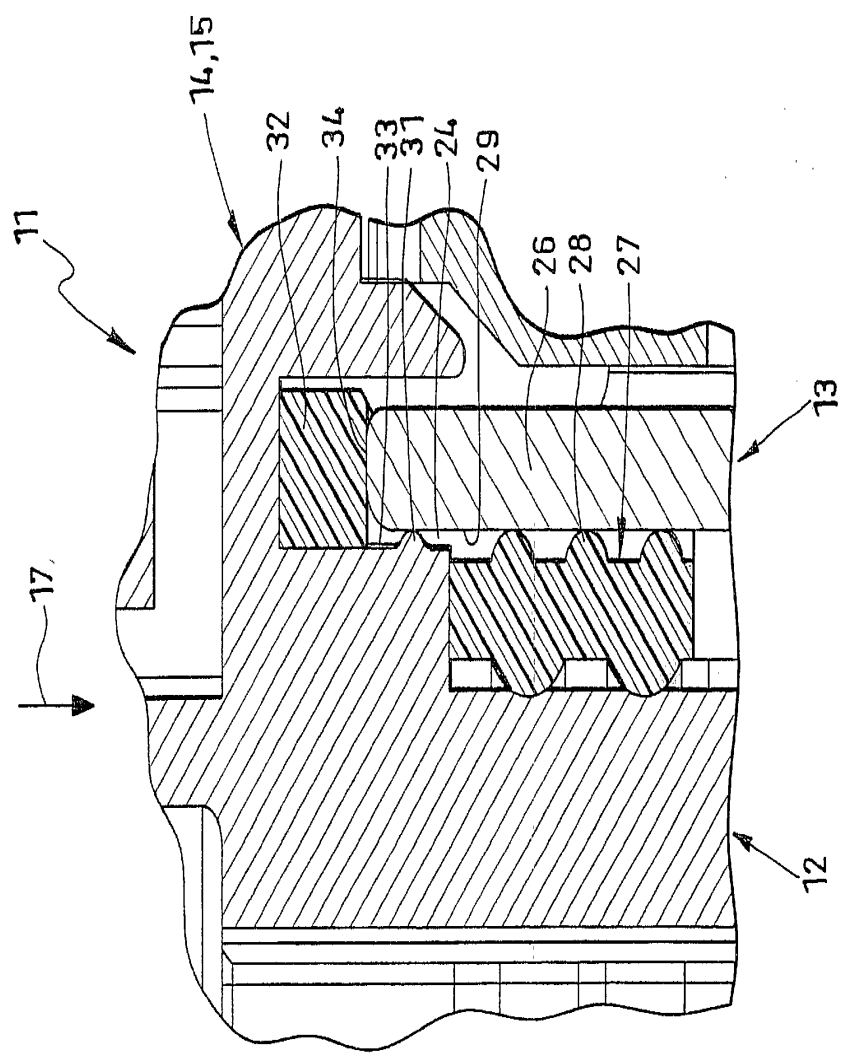
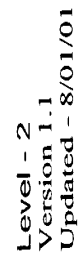
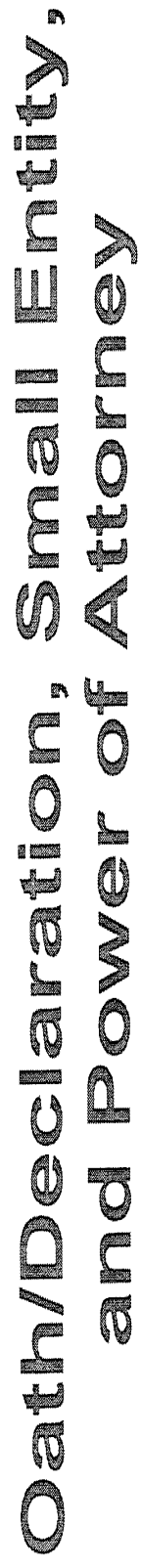


Fig. 2

Figure 1. Schematic representation of the experimental design. The subjects were divided into two groups: the control group (CG) and the experimental group (EG). The CG was divided into two subgroups: the control group (CG) and the control group (CG). The EG was divided into two subgroups: the experimental group (EG) and the experimental group (EG). The subjects were divided into two groups: the control group (CG) and the experimental group (EG). The CG was divided into two subgroups: the control group (CG) and the control group (CG). The EG was divided into two subgroups: the experimental group (EG) and the experimental group (EG).



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COMBINED DECLARATION AND  
POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below adjacent to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled "**ELECTRICAL PLUG CONNECTION**", and the specification of which:

☐ is attached hereto;

☐ was filed as United States Application Serial No. \_\_\_\_\_ on \_\_\_\_\_, \_\_\_\_\_ and was amended by the Preliminary

Amendment filed on \_\_\_\_\_.

☒ was filed as PCT International Application Number PCT/DE01/01147, on the 24<sup>th</sup> day of March 2001.

☒ an English translation of which is filed herewith.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a). I hereby claim foreign priority benefits under Title 35, United States Code § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international applications(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

24003627908

**PRIOR FOREIGN/PCT APPLICATION(S)  
AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119**

Country : Germany

Application No. : 200 06 550.5

Date of Filing: April 8, 2000

Priority Claimed  
Under 35 U.S.C. § 119 : [X] Yes [ ] No

I hereby claim the benefit under Title 35, United States Code § 120 of any United States Application or PCT International Application designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations § 1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

**PRIOR U.S. APPLICATIONS OR  
PCT INTERNATIONAL APPLICATIONS  
DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. § 120**

**U.S. APPLICATIONS**

Number :

Filing Date :

**PCT APPLICATIONS  
DESIGNATING THE U.S.**

PCT Number :

PCT Filing Date :

I hereby appoint the following attorney(s) and/or agents to prosecute the above-identified application and transact all business in the Patent and Trademark Office connected therewith.

(List name(s) and registration number(s)):

Richard L. Mayer,	Reg. No. 22,490
Gerard A. Messina,	Reg. No. 35,952
_____	Reg. No. _____
_____	Reg. No. _____

All correspondence should be sent to:

Richard L. Mayer, Esq.  
Kenyon & Kenyon  
One Broadway  
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## Miscellaneous

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## Summary of the Invention

In comparison with the related art, the plug connection according to the present invention and having the characterizing features of Claim 1 has the advantage that the previously mentioned shortcomings are avoided.

For this purpose, a first pressing element, which is radially pressed against the flange of the mating connector, as well as a second pressing element, which receives an end face of the flange under an axially directed pressing tension at the end of the coupling process of the two connectors, are attached to the first connector in addition to the sealing element. The clearance of motion that was unavoidable in the case of the related art due to the deformability of the sealing element needed for functionality is eliminated by the pressing elements. As a result, the two connectors behave in a coupled state as if they were one piece. This transfers to the contact elements and contact parts situated in the fixed connectors, thereby producing a stable connection.

Due to this formation of the connectors, the vibrational stresses introduced to the contact elements and contact parts are advantageously reduced to the extent that they no longer jeopardize the functionality of the plug connection.

Advantageous measures for implementing the present invention are specified in the dependent claims.

## Brief Description of the Drawing

An exemplary embodiment of the present invention is represented in the drawing and explained in detail in the following description. Figure 1 shows a sectional view of a first connector coupled with a second connector to form an electrical plug connection. Figure 2 shows an enlarged section of Figure 1.

### Description of the Exemplary Embodiment

An electrical plug connection 11 shown in Figures 1, 2 has a first connector 12 and a second connector 13. First connector 12 is configured as a movable cable-harness plug, while second connector 13 is attached in a stationary manner as a attachment plug to an electrical aggregate, in particular to a diesel injection pump. Connectors 12, 13 are detachably coupled to one another.

First connector 12 has a housing 14 formed as a grip-type shell, which is formed as a contact carrier 15 on the inside. As the rest of housing 14, contact carrier 15 is made of an electrically insulating plastic and includes a number of receiving chambers 16 corresponding to the pole number of first connector 12, the receiving chambers penetrating contact carrier 15 in the axial direction, along an arrow 17. Inserted in the direction of arrow 17 in every receiving chamber 16 is a contact element 18, which is only schematically represented.

At one end, contact element 18 has a contact segment 19, via which contact element 18 contacts an associated contact part 21 of second connector 13. Formed at the other end of contact element 18 is a fastening segment 22, to which an electric cable 23 is attached in an electrically contacting manner, the cable, upon emerging from contact carrier 14, being combined in a manner not shown with the other cables of the other contact elements 18 to form a cable harness.

Formed in contact carrier 15 as part of housing 14 is an axially directed, circumferential receiving slot 24 for accommodating an end segment of a corresponding flange 26 of second connector 13 when joining both connectors 12, 13. To seal plug connection 11 between connectors 12, 13, a seal 27 is attached to contact carrier 15.

To form a radial seal, seal 27 has a plurality of circumferential, radially directed sealing lips 28, which are axially offset from one another.



When joining both connectors 12, 13, sealing lips 28 are gripped by sleeve-shaped flange 26 of second connector 13 and are partially resiliently deflected at a side surface 29 of flange 26 in the axial direction, in the opposite direction of arrow 17. Thus, both connectors 12, 13 are sealed relative to each other by seal 27.

In accordance with the deformability necessary for functionality, seal 27 is made of a soft, elastic material, so that given vibrational stresses of plug connection 11, the seal is not able to prevent undesired relative movements between coupled connectors 12, 13 due to vibrational stresses and due to the different masses of both connectors 12, 13.

To rigidly couple connectors 12, 13 also under vibrational stresses, a first pressing element 31 and a second pressing element 32 are provided. First pressing element 31, which is represented in the figures in a superelevated manner, is formed as a circumferential protuberance of contact carrier 15, which is made of an inherently stable plastic, and forms one piece with the contact carrier. In this context, the pressing element protrudes from a sidewall 33 of contact carrier 15 in a radial direction and partially projects into receiving slot 24 such that when inserting flange 26 into receiving slot 24, the pressing element is radially pressed against side surface 29 in the end segment of flange 26.

Alternatively, the circumferential extent of first pressing element 31 can be partially interrupted and can form single pressing regions, the pressing regions also being able to be re-formed into individual pressing points, so-called pressing warts.

Second pressing element 32 is situated at the closed end of receiving slot 24 and is formed as a circumferential ring having rectangular cross-sectional areas. Second pressing element 32 is made of a hard rubber and has a Shore hardness of at least 60. At the end of the coupling operation of both connectors 12, 13, second pressing element 32 receives an end face 34 at the free end of flange 26 under axially directed pressing tension.

As a result of pressing elements 31, 32, both connectors 12, 13 are radially as well as axially biased relatively to each other after the completed coupling process. In this manner, both connectors 12, 13 form a one-piece unit, which can, however, be detached as needed. This one-piece design transfers to contact elements 18 and contact parts 21, which are situated in connectors 12, 13, and whose connection is fixed in the same manner.

As a result of contact elements 18 being connected in a stable manner to contact parts 21, functionality-threatening relative movements between contact elements 18 and contact parts 21 in response to vibrational stresses acting on plug connection 11 are reduced to being uncritical, so that plug connection 11 remains functionally stable even under these unfavorable operating conditions. As a result, it is possible to attach plug connection 11 directly to an aggregate of an internal combustion engine.

